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THE
PHYSIOLOGICAL
INFLUENCE OF ALCOHOL.

BY

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FROM "TWEEDIE'S TEMPERANCE YEAR BOOK."

LONDON: W. TWEEDIE, 337, STRAND.

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The physiological action of alcohol in the human system is a subject upon which there is still scope for more exact definition ; and not only is such definition needed as a groundwork for sound medical teaching as to the prescription or prohibition of alcohol in cases of injury and disease, but it is a topic of vast importance to the general public, who in this country now spend more than 120 millions sterling each year upon alcoholic beverages. The determination of this question, indeed, is fundamental to a wise use of the whole range of saccharine foods, and, therefore, second to none in politico-economical importance.

In the utterances of medical authorities there is much confusion as to the precise effects which alcohol is held to produce in the system, and as to the objects for which it should be administered.

Unfortunately for exactitude in the general discussion, the innumerable varieties of alcoholic beverages now in use can never be brought fairly into line for scientific examination. Even the staple brands of wine are so subject to substitution or adulteration that it is most difficult to procure them with any approach to certainty, and when actually obtained they are found to vary materially with the season, with the accidents of each year's manufacture, and with the time they have remained in cask or in bottle ; of them all, however, I submit broadly that they are taken for the alcohol which they contain, and that none of them would be taken if their alcohol were abstracted. In England, perhaps, a sound, dry sherry wine may fairly be taken as the standard article among alcoholic beverages, and this, in addition to its alcohol and water, contains only infinitesimal matters which confer upon it colour, odour, and flavour. Of its nutritive properties —minus its alcohol and water—one may fairly say as Shakespere says of Gratiano's reasons :—

> They are as two grains of wheat hid in two bushels of chaff ; you shall seek them all day ere you find them ; and when you have them, they are not worth the search.

In our standard medical writers we shall find that alcohol is described as a caustic—an irritant—a stimulant—a narcotic—or a food, according to the prominence of its various reactions with the system.

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* Read to the Physiological Section of the British Medical Association, at the annual meeting in London, August, 1873.

Pereira, in his great work on Materia Medica (p. 1,947) says :—

> The local effects of alcohol, or rectified spirit, are those of a powerfully irritant and caustic poison. To whatever part of the body this agent is applied it causes contraction and condensation of the tissue, and gives rise to pain, heat, redness, and other symptoms of inflammation. These effects depend partially or wholly on the chemical influence of alcohol over the constituents of the tissues; for the affinity of this liquid for water causes it to abstract the latter from soft, living parts with which alcohol is placed in contact; and when these are of an albuminous or fibrinous nature, it coagulates the liquid albumen or fibrin, and increases the density and firmness of the solid albumen or fibrin. The irritation and inflammation set up in parts to which alcohol is applied depend (in part) on the resistance which the living tissue makes to the chemical influence of the poison ; in other words, it is the reaction of the vital powers brought about by the chemical action of alcohol. But, besides the local influence of this liquid, dependent on its affinity, we can hardly refuse to admit a dynamical action, in virtue of which it sets up local irritation and inflammation, independent of its chemical agency. The coagulation of the blood contained in the vessels of the part to which this liquid is applied (an effect which Orfila observed when he killed an animal by injecting alcohol into the cellular tissue of the thigh of a dog), depends on the chemical influence of the poison.

It would be difficult to improve upon this description from Pereira; and we may take it as settled that, in a pure or very concentrated state, alcohol is a caustic substance, which abstracts water from soft animal tissues, and destroys the vitality of the surface to which it is applied. Hence, for searing or hardening certain irritable ulcerated surfaces, alcohol is useful as a local application. When pediculi infest the hair alcohol proves an instant and destructive poison ; in fact, as a safe, handy, cleanly, and remorseless vermin-killer, it will be found to have no rival. As a caustic, the effects of alcohol are neutralised by simple dilution with water. Beyond that point of dilution at which the chemical affinity for water has been entirely satisfied, the effects upon the system depend, not only upon the actual amount ingested, but also upon the extent of aqueous dilution to which it has been subjected. When loaded with enormous quantities of water, alcohol can scarcely be absorbed with sufficient celerity to disturb the system materially, and the more so as the excreting organs are urged to great activity by large aqueous dilution of the blood, and vomiting generally supervenes to empty the stomach. Hence it is difficult for a man to get drunk upon weak table-beer or very weak claret, while the sudden ingestion of a pint of brandy would generally be a fatal dose. Irritation may be described as a coarse form of stimulation. If the influence of alcohol as an irritant—apart from vital reaction consequent upon lesion from its caustic effects—be allowed to merge into its examination as a stimulant, we need only to deal formally with alcohol in relation to the three terms—stimulant, narcotic, food.

The value of alcohol as a food is, I believe, generally considered by the profession as not yet settled, and therefore we need to mark our steps with care. A food may be defined as a digestible or absorbable substance, innocent in relation to the tissues and fluids of the body, and capable of rebuilding the living tissues or of being directly oxydised in the system so as to supply it with force. In this definition we have three tests of a food. To the first test alcohol answers perfectly. It is eminently absorbable, and it is diffused most rapidly through the system without effort on the part of the digestive organs. In these respects, alcohol indeed, if a food, is remarkable as standing apart from all other foods, and whatever force-supplying properties it may have will be infinitely available in cases of exhaustion where digestive power is in abeyance. Grape sugar resembles alcohol in these valuable properties, but cane sugar, though perfectly soluble, and needing no gastric digestion, must undergo assimilation in the liver before it can be utilised as food.

To the second test alcohol does not answer. It is not innocent in the system, but, on the contrary, it is universally recognised as the cause of a large proportion of the degenerative changes which end in disease and early death.

In reference to the third test, we know that alcohol is not a substance that can enter into the construction of any living tissue. Further, we may perhaps remind ourselves that the system cannot, under any circumstances, obtain from a food substance more force than has been stored up in that substance by plant-life; and, also, that this stored-up force can only be yielded up to the system on the oxydation and retrograde metamorphosis of the food substance. Two factors, moreover, must be obtained: 1st, the thermic power—or utmost possible food-value—of alcohol; 2nd, the extent to which that thermic power is elicited in the system.

Now, alcohol is produced by the artificial decomposition of sugar, and, therefore, the thermic-power of alcohol must be less than that contained in the sugar out of which the alcohol was manufactured. Sugar (loaf or cane sugar) yields about 51 per cent of alcohol.* There is in brandy exactly the same percentage of alcohol as that which is yielded by sugar, and, therefore, a pound of sugar is equal in thermic-power to the alcohol in a pound of brandy. So again water containing sugar in percentage equal to that of the alcohol in any other liquor would contain an equal measure of thermic-power. Thermic-power, to the extent that it is elicited in the human system by oxydation, represents vital energy or food-value. Sugared water is largely used by some nations as a refreshing beverage. Sugar is a most valuable food for young children, and for spare, weakly adults; and bees, when fed almost entirely upon sugar, manifest intense energy. Doubtless, the thermic-power of sugar is wholly elicited in the system as vital energy, and physiological data, corresponding exactly with the results of practical experience, show that sugar is completely oxydised in the system. Physiological data will also show how far alcohol is oxydised in the system, and by those data the food-value of alcohol must be determined. The question, therefore, now is how far those data can be defined in reference to the oxydation of alcohol ?

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* In the formation of alcohol 342 grains of loaf sugar take up 18 grains of water to constitute 360 grains of sugar as it exists in the grape—*i.e.*, "grape sugar." The 360 grains of grape sugar break up into 176 grains of carbonic acid gas and 184 of alcohol; therefore, 342 grains of loaf sugar should yield 184 grains of alcohol. In round decimals, this is expressed by saying that 100 parts of loaf sugar take up 5 parts of water to make 105 parts of grape sugar, which should yield 51 parts of carbonic acid and 54 of alcohol. In practice, however, five parts are lost by secondary decompositions, and loaf sugar produces only about 51 per cent. of alcohol. Some further deduction would also have to be made for gross waste in the process of manufacture.

It is well known that shortly after a small draught of any alcoholic beverage has been swallowed, a vinous odour may be recognised in the breath, and this odour is so distinct that the particular beverage which has been taken can generally be predicated by a person of keen smell, provided that his own blood is free from alcoholic admixture. Moreover, after the vinous odour of the breath ceases to be discernible, the presence of alcohol in the excretions of the lungs, of the skin, of the breasts, and of the kidneys, can be demonstrated for some hours longer by means of the usual chemical tests. This proves that even when taken in small quantities, as a dietetic beverage, the entire thermic power of alcohol is not elicited in the system, inasmuch as a portion of the alcohol is excreted unchanged from the blood. As to the remainder, it may be said that the burden of proof lies with those who assert that the undetected alcohol is oxydised to supply force to the system. On this point Professor Frankland, F.R.S., the well-known authority, has favoured me with his opinion in a letter now lying on the table, in which he says :—

> As to the oxydation of alcohol in the system conclusive evidence is still wanting; but there appears to be considerable probability that some at least is oxydised.

I do not know of any reliable data which will carry us further on this point ; but if we estimate that one-third of the alcohol is certainly excreted in an unchanged condition, its possible food-value will not, I think, have been under-estimated.

Again, besides the vinous odour of the breath of alcohol drinkers, there is a well-known fetid odour due to impaired oxydation of effete matters. These effete matters have a positive thermic value, and the extent to which their oxydation is arrested must be counted as a set-off against the food-value of any alcohol which may be oxydised. The presence also of such imperfectly oxydised refuse in the blood lowers the general tone of the system and causes loss of appetite, thirst, lassitude, and sometimes vomiting; while during the course of any severe disease, such as typhus or pneumonia, these putriscible matters must largely conduce to the fatality of the symptoms.

Apart from its merely caustic or irritant effects, all authorities are agreed that alcohol in large doses is a powerful narcotic ; but the fact is scarcely realised that probably more persons are killed suddenly by alcohol than by all other poisons put together. The effects of a large dose of brandy are simply coma, general stupefaction, and universal paralysis, ending, when the respiratory muscles are included, in a mode of death which is indistinguishable from the coma of apoplexy, fracture of the skull, or opium-poisoning. In alcoholic intoxication, short of coma, all the senses are blunted, the higher mental faculties are in abeyance, and the power of directing and harmonising the muscles is more or less completely paralysed. In fact, all the energies of the system are obviously lowered, and these effects, though less profound and less extensive, are, in kind, the same as in the stage of coma. Under the influence of a still smaller dose the prostration of energy is less marked, and the system is capable of contending against the influence of the alcohol. In this condition reactions are manifested which, at first sight, appear to be those of increased energy. But the excitement is merely a play of the coarser faculties let loose by the narcotisation of those finer sympathies which are designed to govern and regulate the others. The excited speaker, instead of thinking aloud, is found to be merely spouting—he declaims more vigorously, but he debates less closely, and in his most brilliant conversation he often depends upon his memory for his wit, and upon his imagination for his facts. There may be explosive manifestations of force in the muscular system; but in endurance, in accuracy, and in all real power, the man is found lower down in the scale. In short, he may be compared to an engine with the balance-wheel taken off—he makes a great deal more noise, but he does a great deal less work, and, from the stage of fatal coma down to the stage of manifest excitement, there will be little difficulty in perceiving that the effects of alcohol are always those of a narcotic, *i. e.*, an agent which lessens sensibility and motricity—which, in short, retards vital activity.*

There is, however, that stage which is called true stimulation, in which a man has taken two glasses of wine, a pint of ale, or an equivalent quantity of spirit fairly diluted with water. Here the dose is described as a stimulant, and therapeutists teach that alcohol, which stupefies and paralyses in large doses, will, when given in small doses, stimulate and strengthen; in fact, that a diminution in the amount of the dose reverses the nature of the effect! We are also told in an off-hand way, that, in cases of exhaustion, we should support the strength with "stimulants," meaning alcoholics. What is the meaning of such phraseology? How is it that we can support a man's strength with stimulants? If words have any meaning, a stimulant is a goad—a something that increases action, and therefore exhausts power by getting out of a man remnants of strength that otherwise would not be parted with. In short, a stimulant is that which gets strength out of a man, instead of putting strength into him; and it is as absurd to talk of "supporting the strength with stimulants" as it would be to talk of supporting the strength of a jaded horse by means of the whip, when what the animal needs is food and rest. Unnatural exhaustion is inevitable after the use of the goad; so that, in cases of exhaustion, to administer a stimulant instead of a food would be a fatal error. If we prescribe alcohol as a food, that is one thing; if we prescribe it as a stimulant, that is quite another. The doctrine that alcohol in small doses acts as a stimulant appears to be grounded upon—first, certain physiological results which are produced by its administration; second, an appeal to general experience on the part of those who use it.

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* I would define a "narcotic" as *that which lessens vital activity.* Alcohol, ether, chloroform, opium, intense cold, and probably all true narcotics seem to lessen vital activity by retarding oxydation in the body. The flame of a candle may be narcotised in the same way by infusing a little alcohol vapour into the air in which the candle is burning, and the experiment beautifully illustrates the results which take place when alcohol is infused into the human blood. The oxydation of the burning matter is at once retarded—the brilliancy of the flame is first lessened, then the flame becomes actually smoky, and, if the quantity of the vapour be further increased, it is extinguished. The flame of the candle perfectly represents the animal tissue in a state of vital activity.

Pereira (page 1,948) says that the remote effects on man may be conveniently considered in the order of their intensity, and after dividing the effects into three degrees or stages, he gives the following description of the first or mildest degree:—

> This is characterised by excitement of the vascular and nervous systems. The pulse is increased in frequency, the face flushed, the eyes animated and perhaps red, the intellectual functions are powerfully excited, the individual is more disposed to joy and pleasure; cares disappear; the ideas flow more easily and are more brilliant. At this period the most violent protestations of love and friendship are frequently made; there is a strong disposition to talk, and various indiscretions are often committed (*in vino veritas*). This degree of effect I presume to be the condition to which all persons aspire in drinking: the unfortunate drinks to drown his cares; the coward to give him courage; the *bon vivant* for the sake of enjoying the society of his friends; the drunkard from mere sensuality. None, perhaps, would wish to go beyond this, yet many when they have got thus far, exceed their intended limit.

The key to the true nature of the phenomena thus lucidly set forth by Pereira, is most likely to be found by examining the one well-defined effect, *i.e.*, the "excitement of the vascular system," and to do this will be the more desirable as the medical administrator of alcohol is generally guided by the effect produced upon the pulse. In medical text-books the routine directions amount to this: Alcohol in small doses increases the activity of the heart's action. It is, therefore, a vital stimulant, and should be given whenever the pulse is feeble.

There is probably as much inaccurate phraseology used about the pulse as about supporting the strength with stimulants, and here we need therefore to ask what is the true meaning of the heart-stroke? I would submit that in a soundly organized animal, the power exerted by the heart is an exact measure of the difficulty of keeping the circulation going. It is only in the systems of highly complex animals that the heart is needed as a part of the circulating apparatus; and, under these circumstances, the heart is a mere accessory organ which distributes the circulating fluid with a certain pressure into the arterioles of the various masses of tissue which make up the body, the ultimate circulation being in every case a self-irrigation on the part of the tissues themselves. Certain also it is that no power possessed by the heart can force the blood through the capillaries. If we simply tie the tracea of an animal so as to stop the passage of air through the lungs, and thus arrest the exchanges between the venous blood in the lung capillaries and the fresh air in the lung cells, we put an immediate end to the circulation although the blood vessels remain pervious, and the sympathetic nerve rouses up the heart to its uttermost exertions in order to force on the current and keep the circulation going. But the real cause of the capillary current in animals is the same as that which moves the sap in plants, *i.e.*, the vital activity of the tissues themselves. This vital activity manifests itself in molecular exchanges between the animal tissues and arterial blood on the one hand, and between the venous blood and fresh air on the other, and it gives rise to elective affinities, which draw into the capillaries blood from the neighbouring arterioles. The vital reactions between the tissues and the irrigating currents having been completed, the capillary blood is passed on into the veins. Thus activity in the stomach, at the time of digestion; in the brain, under mental effort; in the muscles, under bodily exertion, in each case accelerates the blood-current through the particular tissue, just as rapid combustion in a fireplace causes (as well as depends upon) a swift draught of air through the burning material. This accelerated capillary current throws the blood more rapidly into the veins, and, while systemic life endures and the sympathetic nerve is duly sensitive, reflex action urges on the heart to get rid of the blood, and thus keep up a distended state of the arterioles, from which the tissues draw their blood supply. It is, then, the molecular reactions between the tissues and the blood that move the capillary current, and for these reactions we may, perhaps, coin the word *molecularity.* The mechanical conditions on which the capillary current depends are simply an adequate store of blood in the neighbouring arterioles, and a free passage off for the blood that has been used. In complex animal systems a muscular heart and *vaso-motor* nervous system are superadded in order to take up and return the off-going current, but the real pace of the circulation is determined by the general molecular activity of the tissues, and not by the action of the heart. Upon this theory of the circulation, and upon this alone, we get a perfect explanation of the fact that after stoppage of the heart's action the tissues continue to live—if they and the blood are healthy—until they have used up and passed on into the veins all the blood that was stored up in the arterial system. And so universally are the arteries found empty after death, that their very name is derived from the ancient belief that they carried air or vital spirit, and not blood.

It follows that any variations in the innervation or vitality of the tissues, or any change in the quality of the blood, will induce equivalent variations in the rate of the capillary current, and that the action of the heart should respond at once to all such alterations. Hence, in feeble or inactive conditions of system, the heart should work very gently; and the administration of stimulants in a depressed or aged system with a view to urge on the movements of the heart would be much the same as for a child to use a pin in order to prod on the balance wheel of a watch when the mainspring had become lowered in power.

The simile of the fire will enable us to illustrate another point. If the fuel be poor in quality, or the air be imperfectly oxygenated or charged with a small proportion of alcohol vapour, the combustion goes on slowly, the temperature becomes low, and the fire may go out. Here we apply bellows to urge on the draught and keep the fire alight, and this artificial impulse goes to make up for less active reactions between the fuel and the air. Just so when the blood is charged with alcohol, the molecular reactions between the tissues and the blood become dulled, and the increased action of the heart is analagous to the supplementary action of the bellows; it being, in fact, a special effort on the part of the system which is demanded in order to keep the capillary circulation going. Thus we explain the increased vigour of the heart's action under the so-called stimulating doses of alcohol. Under the larger doses we have simply progressive additions of the same influence—the narcotisation is more considerable, the retardation of the capillary current is greater, the capillaries and terminal arteries bcome dilated, and the surface of the body reddens, while the general circulation is obviously weaker. The heart now manifests fatigue as the result of over-exertion, while the activity of its muscles is lessened by the alcoholisation of the blood. The tension of the whole arterial system is also slackened, and the pulse is preternaturally soft and yielding. Under the influence of still larger doses the symptoms are from a very early period manifestly those of general depression, and the ordinary symptoms of narcotic poisoning soon supervene.

If these views as to the physiological action of alcohol be accepted, there will follow a reversal of teaching with regard to the objects for which alcohol is to be used. Instead of being prescribed as a stimulant for the purpose of keeping up the circulation in cases of exhaustion, so as to tide over a temporary period of low water, it must be viewed as a narcotic which blunts the vitality of the tissues and retards the capillary current; which weighs down the action of the heart with useless effort; which adds to the exhaustion and increases the danger. The true and only object for which this potent medicine should be used will be seen to be the induction of those finer shades of narcotisation which are sometimes temporarily useful for retarding over action in some stages of general disease, and for temporarily checking a preternatural mobility of system, such as that which in children some times issues in convulsion and sudden death.

As to the appeal to general experience on the part of those who use alcohol, it is not too much to say that this, if it proves anything, proves a great deal too much. Not only does the unfortunate drink to drown his cares, the coward to give him courage, the *bon vivant* for social enjoyment; not only is alcohol taken as a cure for all diseases, and as the pledge of all our friendships, but it is believed to enable man to resist alike excessive heat and excessive cold, to enable him to do excessive labour of mind or body without incurring the natural consequences of such excess. Gin is sometimes added to the water in which a newly-born child is washed, in order to prevent it from catching cold; the old man is told to take wine to drive on his pulse faster than nature has ordained that it should beat; and the needlewoman who is ill for want of food is told to spend her remaining pence in beer. Alcohol is the antidote to fever-chill, and the soother of fever-heat. It is the remedy for a sprained ankle, a headache, or a stomach-ache, and is often good outside as well as inside.

All this, and much more, is demonstrated by the verdict of experience on the part of those who use it, but others say that such experience must be deceptive. Which alternative are we to take? Sir B. Brodie, in his "Psychological inquiries" (vol. i., p. 143), says:—

> Alcohol removes the uneasy feeling, and the inability of exertion which the want of sleep occasions. But the relief is only temporary. Stimulants do not create nervous power; they merely enable you, as it were, to use up that which is left, and then they leave you more in need of rest than before.

Here we have a definition of stimulants which some later medical writers might well bear in mind when they order alchohol as a stimulant "to support the strength of an exhausted patient." The idea, also, is clearly expressed that alcohol does not supply power, but merely blunts the uneasy feeling which, in case of fatigue, of extreme cold, or of extreme heat, is, in fact, the still small voice of nature warning man that the time for rest or retreat has come. Is the citadel made safe by sending the sentinel to sleep? Does the ostrich escape its pursuers by hiding its head in a bush? Yet that is what man does when he takes alcohol, if it merely disguises the symptoms of injury, and blunts those sensibilities with which he has been furnished.

In conclusion, I submit the following propositions :—

1. That all alcoholic beverages are ordinarily taken for the alcohol they contain, and would not be taken were their alcohol abstracted.
2. That the non-alcoholic constituents of these beverages may all be obtained in their most advantageous condition, and at a fractional cost, in common-place articles of food.
3. That alcohol, if a food, is the most absorbable and rapidly-diffusing food-substance with which we are acquainted, and one, moreover, which is utilisable without effort from the digestive organs, but that, in these respects, an equal quantity of grape sugar would have nearly the same advantages.
4. That the food-value of alcohol cannot exceed that of the sugar from which it is manufactured, and, therefore, its use as an ordinary article of food must, at the present relative prices of sugar and alcohol, be a vast monetary extravagance.
5. That a considerable portion of the alcohol is excreted from the body unchanged, and, therefore, the use of alcoholic beverages must involve fruitless wear and tear of the excretory organs, as well as a total waste of the excreted alcohol.
6. That alcohol, if a food, stands apart from all other foods in its want of innocency in its relations to the tissues.
7. That a large proportion of the degenerative changes which lead to disease and early death grow out of the use of alcoholic beverages.
8. That the presence of alcohol in the blood retards the oxydation of effete matters, and gives a putrescent tendency to the system.
9. That, in large doses, alcohol is a substance which narcotises all animal tissues, and invariably destroys life if administered in sufficient doses.
10. That the so-called stimulating effects of alcohol in small doses are really finer shades of narcotisation, disguised by efforts on the part of the system to excrete an injurious substance and to compensate for its disturbing influence.

I desire, then, to urge, that the so-called stimulating effects of alcohol are really only finer shades of that same narcotic influence which produces general stupefaction and universal paralysis when the agent is given in large doses. In submitting to the physiologists of the British Medical Association a conclusion which is so much at variance with the medical practice of this day, I feel much diffidence. But it is a view which was brought forward by me in a lecture delivered in Manchester in February, 1867. It has since guided my practice at the bedside, with the best results, and lately it has been adopted and published anew by Dr. W. B. Richardson, F.R.S., the well-known experimental physiologist. I trust, therefore, that I shall be excused for having trespassed so long upon the time of this Section.

The discussion was commenced by Dr. Rutherford, who said that, so far as he understood the paper, Dr. Edmunds would prohibit the use of alcohol altogether. (Dr. Edmunds : I say that it acts as a narcotic, and not as a stimulant.) At any rate, he (Dr. Rutherford) was convinced that alcohol would keep up the circulation, and instanced a case where a friend with him walking up-hill was greatly distressed, and out of breath, until he had had some alcohol, after which he went on again.

Professor Binz, of Bonn, said that Dr. Edmunds's mind seemed to have been influenced by the undoubted abuse of alcohol. Abuse, however, ought not to lead us to undervalue so excellent a gift of nature, although, doubtless, labouring persons could get their supply of food much more advantageously in other things than they could in the use of alcohol. The excretion of carbonic acid and urea was decreased by small doses of alcohol. Alcohol in a pure form was not excreted, but only the various ethers, and it was those which gave the vinous odour to the breath. The bichromate of potash test was affected by all urine, even when no alcohol had been taken for six weeks. Dr. Edmunds also had ignored the antipyretic influence of alcohol, which had been clearly proved by experiments with men and dogs under the influence of septicæmia. In such cases the alcohol reduced the fever materially. Professor Binz closed by averring that alcohol should be ranged in that very high rank of medicines which is constituted by such agents as quinine and morphia.

Dr. Mahomed referred at some length to observations with the sphymograph, which showed that alcohol was a specific drug which greatly reduced the frequency of the pulse ; and the speaker went on to describe the case of a girl who had been a total abstainer, but who was sent to him with pneumonia, and considered to be in almost a hopeless condition by the practitioner under whose care she had been. In that case he had administered eight ounces of brandy, and the next day the pulse and fever were so much down that the girl was comparatively safe.

Dr. Edmunds : On what day of the pneumonia did that occur ?

Dr. Mahomed : The fifth ; though perhaps the girl had been ill for a day or two before.

Dr. Wade (Physician to the Birmingham General Hospital) spoke also of the antipyretic influence of alcohol, and said that often, even within a few minutes of the administration of moderate doses, the pulse was reduced several beats in frequency.

Dr. Edmunds being called upon by the chairman to reply, said that he had been much flattered by the amount of attention which had been given to his paper, and he only regretted that the pressure of business in the Section would not allow him to do more than refer to the points which had been raised. Dr. Rutherford's experience would be borne out by that of other practical physicians, and no doubt in many such cases the administration of brandy relieved the distress very greatly. He thought, however, that such relief was more in accord with the theory that alcohol acted as a narcotic than as a stimulant. The greatest relief was perhaps obtained from the alcohol in marked cases of angina pectoris; but here the alcohol blunted the hyperæsthesia which brought about the spasm, and so released the circulation and at once relieved the symptoms—the alcohol, in fact, acting by lessening the morbid irritability of the *vaso-motor* nervous system, not by stimulating the muscular power of the heart. Cases such as those mentioned by Dr. Rutherford really consisted of angina pectoris minor, and were relieved on the same principle. Professor Binz had constructed one of his arguments by the simple process of designating alcohol "a gift of nature." But it remained to show how the calling of alcohol a gift of nature could assist in determining whether alcohol were a stimulant or a narcotic. Arsenic, for instance, was a gift of nature; but that was no reason why we should take a solution of arsenic as a daily beverage! Again, inasmuch as alcohol was never found in the animal, vegetable, or mineral kingdoms, but was always obtained by the artificial decomposition of sugar, he (Dr. Edmunds) failed to see how alcohol was entitled to be eulogised even as "a gift of nature." It was quite true that alcohol lessened the excretion of urea and carbonic acid; but that fact was precisely what would be expected if alcohol were a narcotic which lessened the sum of the vital actions, whereas it would be most difficult to explain if alcohol increased the vital actions, as that would involve more rapid oxydation within the body, and the production of a larger amount of oxydised matter for excretion. The antipyretic influence of alcohol again was in favour of this view instead of against it. Dr. Burdon Sanderson, in the splendid address on physiology which they all still had echoing in their minds, had described fever as a reaction of the system against an injury. Now, deaden those reactions, and you have a reduction in the fever symptoms. In some cases, no doubt, this might be beneficial, but the action was that of a narcotic, not that of a stimulant. Again, as to the case of the teetotal girl to whom Dr. Mahomed had given half a pint of brandy, it came out that the amendment occurred just when any practical physician would look for a crisis ending either in death or in recovery; and he should think it quite as likely that Dr. Mahomed's patient had recovered in spite of the brandy, as that she had recovered in consequence of it. Dr. Edmunds said he regretted that there was no time to deal with the unexpected ground taken by Professor Binz, to the effect that alcohol itself was not exhaled in the breath, and that the bichromatic test was useless. But on these points of fact the views just advanced by Professor Binz were not in accord with those held by other authorities.
